

C4 SITE-SPECIFIC CONCEPTUAL SITE MODEL AND RISK ASSESSMENT FRAMEWORK

This appendix provides a summary of supplemental methods, approaches, media, receptors (human or ecological) and/or exposure pathways that may be necessary to evaluate the Division Street Station Operable Unit (OU) and were not included in the Generalized Conceptual Site Model (CSM), Revision 1, dated August 2007 (Integrus 2007) and Multi-Site Risk Assessment Framework (RAF), dated September 2007 (Exponent 2007). A general Baseline Risk Assessment Report (BLRA) outline is presented in the RAF (Exponent 2007).

1.1 Additional Potential Receptors and Media Identified in Site Reconnaissance

Soil vapor, related to vapor intrusion into buildings, is a media of potential concern for buildings adjacent to the Finkl Parcel, and on the ComEd, Peoples Gas and Marcey Parcels of the OU. The human health risk assessment methods for this potential exposure pathway are described below.

1.2 Supplemental Human Health Risk Assessment Methods

1.2.1 Data Evaluation Process for Vapor Intrusion Assessments

1.2.1.1 Introduction

The purpose of this document is to provide a general framework for evaluating the data obtained during vapor intrusion assessments. Vapor intrusion assessments will generally include the evaluation of data from multiple media, potentially including soil, groundwater, soil gas, sub-slab soil gas, and/or indoor air. Data from each medium will be evaluated individually for validity and usability, as well as in combination with data from other media in order to consider multiple lines of evidence in determining whether vapor intrusion poses potential human health risks. Data can be limited to visual observations, PID readings and odors noted to actual laboratory analytical data. The evaluation process conceptually follows the tiered approach presented in *United States*

Environmental Protection Agency (USEPA) Office of Solid Waste and Emergency Response (OSWER) Draft Subsurface Vapor Intrusion Guidance (November 2002) by proceeding from a generic screening assessment to a site-specific pathway assessment if necessary. The most updated published attenuation factors contained *USEPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors (2008)* will be used for generic screening level calculations.

1.2.1.2 Medium-Specific Evaluation of Analytical Data

Data from different media are appropriate to use for different purposes. For example, most regulatory agencies consider soil data to be inappropriate for evaluating potential exposure due to vapor intrusion; however, soil data can be very useful to identify locations for groundwater and/or soil gas sampling. Each environmental medium also has similar benefits and limitations. The following paragraphs discuss the appropriate uses of data from each medium and provide a general description of how the data will be evaluated.

Soil

Limited empirical data are available establishing attenuation factors from soil to indoor air, and modeling vapor intrusion from soil can be unreliable due to the heterogeneous nature of the medium. As a result of these data limitations, evaluating vapor intrusion from soil may be less reliable than evaluating vapor intrusion from other media, such as soil gas and sub-slab soil gas. In consideration of these limitations, observations or analytical data of soil at the groundwater table interface will primarily be used as means of identifying locations for collecting soil gas samples. Soil gas samples will be collected from areas where soil sampling has indicated the potential for residual contamination to be present. Residual contamination can be identified based on visual observations, PID readings or odor. If none of these indications is present, then soil and/or groundwater data can be reviewed.

Groundwater

Groundwater data can also be used as a means of identifying soil gas and/or sub-slab soil gas sample locations. Additionally, groundwater data will also be used as one line of evidence to establish whether or not vapor intrusion poses potential risk at a site or OU.

USEPA has compiled empirical data on attenuation factors from groundwater to indoor air (USEPA, 2008), and these data can be used to calculate generic screening levels for groundwater. Generic screening levels for groundwater are defined as risk-based screening levels protective of indoor air exposures that are calculated using published attenuation factors from groundwater to indoor air. These screening levels are intended to be used in comparison to analytical data from groundwater as a conservative initial evaluation tool. Since generic attenuation factors are available for groundwater, generic screening levels can be calculated. Groundwater data from a site or OU, if available may be compared to generic screening levels to identify areas where soil gas sampling is warranted. Otherwise, if contamination is identified when groundwater monitoring well installation is occurring, then that evidence may be used in determining where to install probes and collect soil gas samples. This is the initial plan at this OU. If at all possible, soil gas probe locations will be established based on what has been documented in drilling logs, so that demobilization and re-mobilization are not required. Additional locations where soil gas sampling would be prudent may be identified in the field.

Groundwater data will also be used in conjunction with soil gas and/or sub-slab data to provide evidence of the presence or absence of a migration pathway from the subsurface to indoor air. Evaluating analytical data from groundwater along with soil gas data from multiple depth intervals provides a means of tracking the upward vertical migration of vapor-phase chemicals.

Soil Gas and Sub-Slab Soil Gas

Soil gas and sub-slab soil gas will be the primary media used to evaluate whether the vapor intrusion pathway is complete and has the potential to pose unacceptable risk to human health. Collecting exterior soil gas samples is less intrusive to building occupants, and exterior soil gas is less likely to be influenced by the building pressure variations that can cause sub-slab soil gas data to be highly variable. For these reasons, exterior soil gas sampling is the preferred method of vapor intrusion investigation; however, sub-slab soil gas samples will be collected at the Willow Street / Hawthorne Avenue Station OU, if deemed necessary based on data collected during the RI. The decision to collect sub-slab soil gas samples based on several factors: the size and location of buildings, known information regarding distribution of impacts, uncertainty regarding the presence or absence of impacts under existing buildings and past historical

remediation that has occurred near the buildings, such that exterior soil gas samples collected may not represent conditions underlying the buildings.

USEPA has compiled empirical data on attenuation factors from soil gas (and sub-slab soil gas) to indoor air, and these data can be used to calculate generic soil gas (and sub-slab soil gas) screening levels. Generic screening levels for soil gas (and sub-slab soil gas) are defined as risk-based screening levels protective of indoor air exposures that are calculated using published attenuation factors from soil gas (or sub-slab soil gas) to indoor air. These screening levels are intended to be used in comparison to analytical data from soil gas (or sub-slab soil gas) as a conservative initial evaluation tool. Soil gas and/or sub-slab soil gas data will be compared to generic screening levels to determine whether additional evaluation or mitigation is warranted. If exterior soil gas data exceed generic screening levels, consideration will be given to either calculating site-specific soil gas screening levels or collecting sub-slab soil gas samples. Site-specific soil gas screening levels can be calculated by replacing the published attenuation factor used in the generic calculation with a site-specific attenuation factor derived from vertical soil gas concentration profiles. If sub-slab soil gas data exceed generic sub-slab soil gas screening levels, site-specific sub-slab soil gas screening levels will be calculated using site-specific attenuation factors. If sub-slab soil gas data also exceed site-specific screening levels, consideration will be given to either collecting indoor air samples or taking mitigation measures.

Indoor Air

This vapor intrusion program is designed with the intent of not performing indoor air sampling to the extent feasible. The constituents of interest at former MGP sites are also commonly present in household and commercial products, and the likely presence of indoor sources of site-related compounds confounds interpretation of the resulting analytical data; however, should indoor air sampling be warranted, the resulting data will be used in conjunction with soil gas, sub-slab, outdoor (ambient) air, and/or groundwater data to establish the presence or absence of a completed vapor intrusion pathway. If it is concluded that constituents in indoor air are likely present as a result of vapor intrusion, the indoor air data will be used to evaluate potential risks to human health. Risks to human health will either be evaluated by comparing the analytical data to risk-based screening levels for indoor air or through completing a site-specific risk assessment.

1.2.1.3 Risk-Based Screening Levels for Evaluating Vapor Intrusion

There are two types of screening levels that may be used to judge the potential for health risk – levels based on direct exposure to air, and levels that are derived to represent a source medium such as groundwater and soil gas. The first category includes concentration-based values ($\mu\text{g}/\text{m}^3$ of air) that are applicable to indoor air. These values are derived based on the following site-specific considerations:

- Use of the building (residence, school, office space, storage area, etc.);
- Age and behaviors of people associated with the use of the building;
- Distinctions in use, as appropriate, between basements, ground floors and upper floors;
- Applicable lifetime cancer and sub-chronic or chronic health target levels; and
- Published values on toxic potency (e.g., reference doses, reference concentrations, and unit risk values)

The second category represents values that may be developed to correspond with measurements of soil gas, soil, or groundwater. This set of values is considered a source term that may lead to a particular indoor air concentration. The second set of values is derived from the applicable indoor air target levels by applying appropriate attenuation factors to represent how concentrations attenuate as vapors move through the vadose zone and pass into the building structure. It is anticipated that standard models and attenuation factors representative of particular soil and building types will be used to calculate soil gas values that could result in the indoor air risk-based levels. Because there are several types of soil gas measurements that might be developed for a site-specific investigation, attenuation factors can vary. For example, the attenuation factor applied to a soil gas measurement taken beneath the slab or a building would differ from that made just above the soil/groundwater interface several feet below the ground surface. Because of the site-specific variables associated with deriving appropriate attenuation factors, each case must be considered separately; however, these types of considerations are the same across sites and can draw from common databases (e.g., USEPA, 2008; ASTM, 2008) and models. When collecting soil gas and sub-slab soil gas samples, fixed gases (i.e., oxygen, carbon dioxide, and methane) will be included in the analytical suite. Data on fixed gases can be used to evaluate the potential

for bioattenuation, which can then be used to support site-specific attenuation factors and site-specific screening levels.

1.3 Supplemental Ecological Risk Assessment Methods

are no additional risk assessment methods beyond those presented in the CSM (Integrays 2007) and Multi-Site RAF (Exponent 2007) necessary to evaluate ecological receptors and media to be considered at the Willow Street / Hawthorne Avenue Station OU.

1.4 References

ASTM International, 2008. *ASTM E2600-08 Standard Practice for Assessment of Vapor Intrusion into Structures on Property Involved in Real Estate Transactions*.

Exponent, 2007, *Multi-Site Risk Assessment Framework*

Integrays, 2007, *Generalized Conceptual Site Model*

USEPA, 2004, *United States Environmental Protection Agency (USEPA) Office of Solid Waste and Emergency Response (OSWER) Subsurface Vapor Intrusion Guidance, EPA 530-D-02-004*.

USEPA, 2008. *U.S. EPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors*. Office of Solid Waste, U.S. Environmental Protection Agency, Washington, DC 20460.